Impact of Science on the Economics of Tea Industry

3rd International Conference on
Global Advances in Tea Science
Held at Kolkata November 18-20, 2003

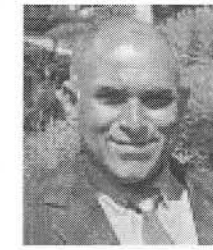
PART VII
CONTRIBUTED ARTICLES

Chapter 47

INTERNATIONAL SOCIETY OF TEA SCIENCE

(Objectives, Genesis, Organization, Activities and Vision)

N.K. Jain



Seventy year old Prof. Narender kumar Jain is the Founder Secretary of the International Society of Tea Science which was registered in 2000. He brought to this Society a background of an academic career par excellence *and a highly commended performance record as a teacher, a researcher, an author, an institute builder and an organizer. The International Society of Tea Science (ISTS) is a premier institution using information technology for promoting research in tea science, tea technology and tea industry. It has built information linkages with many International tea research institutes located as far apart as Russia, China, Japan, Indonesia, Srilanka, Kenya and Argentina. The Society was registered vide certificate number 32866 of 1998 under the N.C.T. Delhi Indian Societies Registration Act XXI of 1860 with the primary objective of promoting research in broad filed of information technology as applied to tea science and technology and its application to the tea industry. For objective and activities of ISTS, please visit our* ***Website <http\\www.teascience.org>***.

OBJECTIVES

The proximate objectives of the ISTS are to:

- Collect, collate and store technical information on global advances in tea science and disseminate the same by traditional and electronic means.
- Build information linkages with international tea research institutes, tea scientists and members of the tea industry.
- Publish quarterly journal The International Journal of Tea Science (IJTS) comprising research papers, review papers and scientific abstracts of recently published research reports.
- Publish books, directories, bulletins and reports relevant to the research needs of global tea industry.
- Hold international conferences for elucidating the impact of latest scientific developments on the global tea industry.

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GENESIS

The genesis of the Society can be traced to 1993, when at an aside discussion in TRA organized International Conference, a compendium was conceived by a few friends to include information on all aspects of tea science and tea industry. Authors were identified on the basis of their specialization and response. Invitations were sent out, manuscripts received and edited in the following two years. In 1995, a conference was proposed to discuss the manuscripts received for the edited book "Global Advances in Tea Science". In 1996, two conferences were held, one in Beijing (China) under the aegis of the FAO and the other in Delhi with the grant received from Ministry of Commerce, Government of India and the Council of Scientific and Industrial Research (CSIR). In the latter meet, the delegates recommended organization of an International Society of Tea Science (ISTS) with the primary objective of publishing peer-reviewed research papers and topical reviews, exclusively on tea. It was also proposed to collect, collate, classify and disseminate abstracts of all scientific papers published on tea any where in the world. The

Society was registered in 1998 and became the International Society of Tea Science in April 2000.

ORGANISATION

The Governing Body of the ISTS comprises 8 members including Founder President of the ISTS Dr. Ashok Jain, Director, Institute of Informatics & Communication, South Campus, University of Delhi, and the former Director, National Institute of Science Technology and Development Studies (NISTADS); Mr. M.P.S. Siddhu, former Managing Director, The Assam Company and Dr. Chen Zong Mao, former Director, Tea Research Institute of China are Vice Presidents; Dr. N.K. Jain, former Director, Tocklai and founder Director, Institute of Himalayan Bioresource Technology (IHBT) is the Founder Secretary and Editor, International Journal of Tea Science (IJTS); Dr. D.P. Chakraborty former R&D Advisor to Fertilizer Corporation of India is the Founder Treasurer.

ACHIVEMENTS

1. Information linkages with 15 International Tea Research Institutions, with >70 Active Members and >60 Intellectual Associate Members
2. Published five issues of IJTS containing 20+ reviews and 2000 research abstracts
3. Proposed six special issues of IJTS on Tea & Health (published), Pesticide Residues, Bio-Pesticides, Germ Plasm Characterization, Sustainable Tea, and Cost Price Squeeze
4. Books three: Published one1998, scheduled two in 2003-2004
5. Conferences: 1996 Beijing, 1996 Delhi and 2003 at Kolkata

ACTIVITIES

Book Published

GLOBAL ADVANCES IN TEA SCIENCE (1999). Ed. N.K. Jain. Aravalli Books International, New Delhi -110020.

Review to the above book by John Weisburger, Director Emeritus, American Health Foundation, published in September 2003 issue of Journal of American College of Health is given below.

"As the title of this book implies, its contents extend over 882 pages on topics relevant to factors having to do with varied aspects of tea, worldwide an important beverage. In the USA, about 36% of men and 64% of women consume hot tea, more in the northeast than in other parts of the USA. On the other hand both men and women consume iced-tea equally, and most of it is drunk in the South.

Tea was discovered in about 4,000 BC in China. During processing turned it to green tea. Subsequently, tea was discovered in Assam Province of Northern India, and this product was manufactured to yield black tea. There are 84 authors and co-authors. The initial chapters deals with the science and technology of tea industry in various producing countries in Asia, Africa, Australia, Southern Russia and Argentina. Another series of chapters comment on technology transfer. The economic aspects of the world tea industry are covered in nine chapters, including four dealing with human health. An important area deals with the tea production as regards the agricultural aspects and botany of tea, as well as the technology associated with tea in various countries. Series of individual chapters comment on tea chemistry, especially the tea aroma, chemicals and flavor. Tea processing as regards green, oolong and black tea and the non-beverage applications of tea products are reviewed. The production of organic tea is described.

It is true that the tea plant and the tea leaves are mostly resistant to insects and thus do not require usually many pesticides. Yet there are regulations in various countries about pesticide application, and the resulting content maximum of the tea to be marketed with such contaminants. The book contains beautiful colored illustrations of tea plantations, tea production factories and tea auctions involved in marketing tea. There are in photographs featuring various tea products as well as of tea beverages. There is

comprehensive subject index of 20 pages, permitting the rapid location of chapters or topics of interest. Anyone concerned with tea in its many aspects, from the tea plant in the world to tea as a beverage and the health effects can be found in this important monograph. Specialists in food and nutrition will find this a valuable resource. After all, nutrition means to inquire not only about foods to be consumed as solids, but also beverages that are drunk. Incidentally, one chapter in the monograph on tea in Japan was provided by Dr. Y. Hara, who recently published a small book of 252 pages (M. Dekker, 2001) dealing with tea with emphasis on health benefits and applications".

Future Books Proposed

❖ **Chemoprotective effects of tea on human health**

Publisher: CABI Publishing

Honorary editors:

- Dr. John Weisburger, Director Emeritus, American Health Foundation
- Dr. Maqsood Siddiqi, Director Bose Institute

Proposed date of receiving the manuscript: End November 2004

Proposed titles of chapters and invited authors:

Proposed title of chapter	Invited author
Tea in Lowering the Risk of Chronic Diseases	John Weisburger
Tea as Prevention / Protective Against Human Diseases	Yukihiko Hara
Chemo-Preventive Effects of Tea Against	
a. Cancer	Maqsood Siddiqi
b. Cardiovascular Diseases	Sheila Wiseman
c. Athereosclerosis	Takako A. Tomita
d. Gastroentritis	Tommo Homma
e. Neural Ailments Like Alzheimer	Takami Kakuda
f. Diabetes*	
g. Arthritis	Hasan Mukhtar
h. Kidney/Nephritis	Lekh Raj Juneja
i. Liver/Hepatitis	Dilawari
j. Obesity	Hasegawa
k. Lung/Pulmonary Ailments	Hemamatsu / Hiroshi Yamada
l. Oral Hygiene/Bad Breath	Lucy Hwang
m. Edema*	
n. Senescence/Aging	Keiko Unno
o. Allergies*	
Tea As Health Food Supplement	T.Takeo
Tea in Human Nutrition	V. Prakash
Genotoxic Properties of Tea	Y. Shukla
Bioavailability of Tea	C.S. Yang
Immuno-Dilatory Effects of Tea	G.N. Qazi

❖ **Critical Issues Related to Tea Industry**

This CABI proposed book invites authors in their areas of specialization for any of the chapters listed hereunder. This will also form a part of a CABI compendium when compiled. The list attempts to put together critical issues facing the tea scientists and captains of the tea industry. The list is neither exhaustive nor mutually exclusive. Comprehensive essays by persons with keen analytical minds in the industry and amongst scientist are invited to enable non-technical readers and decision makers to understand the key issues of this industry in their proper perspective.

Critical Areas of Relevance to Tea Industry

A. Production
B. Processing
C. Products & Marketing
D. Information Management
E. Environmental
F. Economic Parameters
G. Social & Historical
H. Interface with Infrastructure Systems
I. Institutions of Governance & Research

A. Production Related Issues

1. Biodiversity

2. Geographical Distribution

3. Adaptation Mechanism: Profile of Tea Plant
   - Species Forms
   - Anatomical Structures

4. Physiology of
   - Photosynthesis
   - Nutrition
   - Response to External Stimuli
   - Plant Browth Regulation

5. Reproduction / Multiplication

6. Germ Plasm
   - Characterization
   - Evaluation
   - Availability - Maintenance of Germ Plasm Banks
   - Utilization: Past, Present, Future
   - Biotechnology
   - Genetic Engineering
   - Clonal Selection
   - Breeding for Yield & Quality

7. Plant Nutrition
   - Role of Nutrients
   - Sources of Nutrients
   - Application Practices in Different Countries

8. Plant Protection - Against Pests, Diseases, Weeds
   - Chemical Control: New Molecules, Pesticide Residues, MRLs
   - Integrated Pest Management (IPM)
   - Biological Control

9. Plucking
   - Manual – Work-Study, Time & Motion Studies
   - Aided
   - Mechanical
   - Computer Controlled
   - Cost Control
   - Plucking Frequency
   - Factors Affecting

10. Pruning
    - Factors Affecting Pruning Systems
    - Relationship with Plucking and Manuring
    - Equipment for Pruning
    - Pre & Post Pruning Care

B. Processing

1. Product Profile: Green, Oolong, Black, Instant Tea

2. Precursors for Flavors and for Cup Characters

3. Processing Machinery

4. Process Control

5. TQM/ HACCP Concept of Quality Management

6. Trouble Shooting on Shop Floor

7. Systems of Manufacture Related to Organization
   - Cottage Scale or Household
   - Bought Leaf Factories
   - Corporative
   - Captive Large Plants

8. Energy
   - Needs
   - Sources, Including Solar Energy and Biomass Gasification
   - Energy Conservation

9. Water Supply for Factories and Waste Disposal

C. Products & Marketing

1. Tea And Health
   - Food & Nutraceutical
   - Chemo Preventive Effect of Tea on
     - Cancer / Genotoxicity
     - Cardiovascular / Arteriosclerosis
     - Kidney / Nephritis
     - Diabetes
     - Gastro-Enteritis
     - Lung Ailments

- Neural Ailments
- Arthritis
- Oral Hygiene
- Viral Ailments Like AIDS, Common Cold
- Senescence/ Aging

2. Value Added Non-Beverage Products From Tea
   - Industrial Products
   - Pharmaceuticals
   - Nutraceutical / Food Products
   - Cosmetics
   - Personal Hygiene Products

3. Marketing Products
   - Products: Instant Tea, Organic Tea, Speciality Tea
   - Packing & Transport
     - Bulk: Packing Systems - Merits & Demerits
     - Means of Transport
   - Tea Auctions including e-auctions v/s Private Sales
   - Consumer Profile
   - Retail Sales
     - Retail Outlets
     - Loose Tea
     - Tea Bags
     - RTD
   - Consumer Research

D. Information Management

1. Information Technology for Scientists

2. Transfer of Technology (Extension) for Small Holder Growers in India (Nilgiris, Kerala, Kangra, North East India i.e. Assam, Dooars), China, Kenya, Indonesia, Srilanka, Tanzania.

3. Technology Transfer for Organized Sector in India, Kenya, Central & South Africa, Srilanka, Indonesia, China, Russia

4. Role of Training in Plantation Management

5. Role of Computers in
   - Informatics
   - Production
   - Tea Handling
   - Estate-Management
   - Tea Marketing.

E. Environmental Issues

1. Organic Tea

2. Environment Friendly Tea

3. Impact of Tea Production & Processing on Environment Maintenance or Its Degradation

4. Sustainable Tea
   - Sustainable Agricultural Practices
   - Irrigation for Sustainable Production
   - Drainage for Sustainable Production
   - Sustainable Nutrition
   - Sustainable Pest Control
   - Sustainable Processing and Waste Disposal
   - Sustainable Energy Utilization
   - Trees for Shades and Fuel
   - Economic Sustainability
   - Environmental Sustainability
   - Small Holders Sustainability
   - Economic Sustainability of Estate Plantation in the Present Context

F. Economic Issues

1. Financing Tea Development
   - Country Financing
   - Estate Financing
   - Financing The Smallholder Grower

2. Problems in Opening New Tea Plantation Areas

3. Rehabilitation of Dilapidated Tea Areas - Case Studies

4. Economic Parameters
   - Employment Generation
   - Income Generation
   - Domestic Consumption
   - Export Enlargement

- Tax Contribution to Exchequer

5. Smallholder Tea Growers
   - Profiles of Small Holder Growers in Kenya, India, Sri Lanka, China, Indonesia
   - Economic Sustainability of Smallholder Growers
   - Systems of Production, Processing and Marketing
   - Technical Support Systems
   - Cost Price Profile for Small Growers

6. Organized Plantation Sector
   - Profile of Tea Plantations in India, Kenya, Indonesia, China, Russia, Georgia
   - Social Responsibility Shared by Plantation Sector
   - Land Laws Governing Plantation Sector
   - Management Systems
   - Technical Support Systems
   - Cost Price Profile of Plantation Sectors

7. Movement of Costs & Prices: Historical Prospective and Current Situation

G. Social and Historical Aspects of Tea Industry

1. Community Service

2. History of Introduction and Establishment of Tea Plantation In Different Regions

3. Labour In Tea Plantations
   - Hiring Systems
   - Living Conditions
   - Work Environment
   - Health of Plantation Labour
   - Labour Unions-History and Their Role
   - Work Study, Time and Motion Study

4. Spread of Tea Culture - Tea in Social Etiquette

5. Tea in Folklore

H. Interface with Infrastructure Systems and Institutions

1. Organizations for Interface with Policy Makers

2. Role of Tea-Producer Associations

3. R & D Institutions
   - Organization and Funding
   - Role in Supporting Tea Growers i.e. Technology Transfer
   - Track Record in Effective Transfer of Technology
   - Fundamental versus Applied Research
   - Return on Investment on Research

4. WTO Membership - Impact on Tea Industry

5. Role of FAO and Intergovernmental Group

6. Role of Tea Boards

7. Role of NABARD and Other Financial Institutions

Journal

International Journal of Tea Science (IJTS), including Tea Science Abstracts, brings to you:

- State-of-the-art subject reviews
- Peer-reviewed research papers
- Notes and news
- Book reviews
- World scan of tea literature through bibliographic abstracts

It provides you world literature in tea science comprising >5,000 bibliographic documents in 1990-1995, which is growing by the day.

USERS AND BENEFICIARIES

- Tea scientists and students
- Corporate tea industry
- Progressive tea growers
- Policy makers
- Financial institutions
- Students of tea science
- Tea machinery manufacturers

- Tea-input suppliers
- Value-added products industry
- Tea-based pharmaceutical & cosmetic Industry

ISSUES OF JOURNAL ALREADY PUBLISHED

For editorial, please see the website **<teascience.org.>**.

Volume 1 (1) September 26, 2001

- Fertilizers on Tea Yields and Quality by P. Okinda Owuor
- Industrial Utilization of Tea Extract by T. Takeo
- Sulphur Nutrition of Tea by T. N. Rao and P.K. Sharma
- Tea Statistics: Production & Export of Major Producing Countries
- Tea Science Abstracts

Volume 1 (2&3) August 28, 2002

- Oolong Tea - Roasting Temperatures by I. Ming. Juan
- Total Quality Management - HACCP Perspective by V.G. Dhanakumar.
- Bibliography of Camellia Biotechnology by P.K. Mondal
- Tea Statistics - Performance of Kenya.
- Tea Science Abstracts

Volume 1 (4) December 31, 2002

- Ecophysiology of Darjeeling Tea Clones by S.E. Kabir
- Tea Rhizosphere - Microbeal Diversity by A. Pandey & L.M.S. Palni
- Notes on Bought-Leaf Factories by Gita Narrayani.
- Statistics: Tea Imports by Pakistan.
- Tea Science Abstracts.

Volume 2 (1&2, Tea & Health Special Issue) March 16, 2003

Honorary editors:

John. W. Weisburger & Maqsood Siddiqi

- Lowering Risk of Chronic Disease by John. Weisburger
- Health Promoting Beverage by Hasan Mukhtar et. al.
- Prevention / Protection Against Human Diseases by Yukiyuko Hara.
- GTP as Food Additive and Supplemental Factor by Tadakazu Takeo
- Cellular Survival-Immunity in Mice Understress by Maqsood Siddiqi et. al.
- Antigenotoxic Potential by Yogeshwar Shukla.

- GTP Against Renal Disorders by Lekh Raj Juneja, T.P. Rao. et. al.
- Nutraceutical Properties by P. Pushpangadan and P.G. Latha.
- Tea Statistics -Cost Price Squeeze Faced by The Indian Tea Industry
- Tea Science Abstracts Pertaining To Health: Number 374.

Volume 2 (3) July 28, 2003

- Tea & Health - Popular Article by Biman Basu
- Small Tea Growers of Niligiris by K.V.S. Krishna
- Specialty Teas by Sanjay Kapoor
- Japan Tea Market by N. Miura
- Middle East Tea Market by Mehndi Gerami
- Statistic Analysis in Trends of Tea In China
- Tea Science Abstracts - in New Classification

PROPOSED ISSUES OF JOURNAL TO BE PUBLISHED

Volume 2 (4), Special Issue on Pesticide Residues

Honorary editor:

Dr. P.K. Seth, Director Industrial Toxicological Research Center

Scheduled date of publication: November 2003

Proposed papers and invited authors:

Title	Author
Impact of Pesticide Residues in Tea on Human Health	PK. Seth
Analytical Methods for Tea Pesticide Residues	M.S.Mithyantha
Regulatory Requirements of Tea Pesticide Residues	T.C.Choudhury *German Tea Council* N. P. Agnihotri
Fate of Pesticides in Tea - A Review	Adarsh Shankar
Fate of Pesticides in Tea Bush	Chen Zong Mao

Volume 3 (1&2), Special Issue on Biopesticides

Guest editors:

Dr. A.N. Mukhopadhyay and Dr. Nalini Gnanapragasan

Proposed papers and invited authors:

Title	Author
Bio-Pesticides for Control of Tea Pests	Seema Wahab
Chinese Experience of Biological Control	Bao_yu Han
Neem as Biocide for Tea Pests	N. Ramarathenam
Mycoherbicides for Tea	Carol Ellison
Lifecycle of Predators on Tea Pests	B. Banerjee
Organic Tea	N. Muraleedharan S. Kodomari
Antagonistic Fungi for Tea Diseases	A.N. Mukhopadhyay

Volume 3 (3&4) Conference Proceedings

Volume 4 (1&2)Miscellaneous papers

Volume 4 (3&4)Special Issue on Germ Plasm Evaluation

Guest editors:

Dr. Malathi Lakshmi Kumaran, Tata Energy Research Institute.

Dr. L.M.S. Palni, Uttranchal State Biotechnology programme.

Proposed papers and invited authors:

Title	Author
Objectives, Approach & Strategy of Tea Characterization	L.M.S. Palni
Early Evaluation of Cup-Quality Potential	Nigel T. Melican
Field Performance of Candidate Clones	D.N. Barua
Cytogenetic Techniques of Tea Clones Characterization	S.N. Raina
Variability and Finger Printing for Tea Germplasm	Malathi Kumaran
Biochemical Parameters for Tea Characterization	Raj Kumar
Physiological Parameters for Tea Characterization	A. Baragohain
Molecular Tools of Characterization	Swati Sen Mandi S. Yamaguchi

Molecular Characterization of Japanese & Korean Teas	P.K. Pius
Genomic Sequencing in Tea	S.K. Nandi
Genetic Fidelity of Tissue Cultured Tea Plants	Sanjay Kumar
Gene Isolation in Tea	P.S. Ahuja
Transgenics in Tea	

Volume 5(1 & 2), Special Issue on Sustainable Tea

Guest editors:

Dr. Caleb Othieno, Former Director, Tea Research foundation, Kenya

Dr. Dennis Gerrity, Director General, International Forestry Research Center, Kenya

Proposed papers and invited authors:

Title	Author
Sustainable Agriculture Practices in Tea	C. Othieno
Irrigation in Sustainable Agriculture of Tea	M.K.V. Carr
Irrigation -Indian Experience	M.J. Pook
Drainage for Sustainable Tea Production	Bhupal Singh
Tea Nutrition in Sustainable Tea Production	L. Manivel
Sustainable Pest Control	N. Muraleedharan
Biopesticides for Control Tea Pests	M.C. Sharma
Sustaniable Tea Processing & Waste Disposal	Nigel T. Melican
Sustainable Energy Supply for Tea Processing	S. Dasappa
Eco-Friendly Tea Growing	Sivepalan
Trees for Shade & Fuel in Tea Plantations	Agroforestry center

INTERNATIONAL CONFERENCES

- 1ST - Global Advances in Tea Science: July 7-9, 1996 at Beijing, China (under aegis of FAO)
- 2nd — Global Advances in Tea Science: October 14-16, 1996 at Delhi (under aegis of CSIR and Tea Board)
- 3rd — Global Advances in Tea Science: November 20-22, 2003 at Kolkata (under aegis of Tea Board) on Impact of Science on the Economics of Tea Industry

Background

Tea industry has become a victim of the harsh economic realities. While the prices are depressed, the cost of production continues to climb. Lest the cost-price squeeze kills the tea industry as an economic activity, this conference has been organized to discuss how science can help to meet the unprecedented crisis.

Theme

Impact of Science on the Economics of Tea Industry

Occasion

Golden Jubilee of the Tea Board of India

Joint Organizers

International Society of Tea science
Tea Board of India
Bose Institute

Sponsors

Department of Science & Technology (DST)
Food & Agriculture Organization (FAO)
National Bank of Agricultural & Rural Development (NABARD)
Council of Scientific & Industrial Research (CSIR)

Associated Institutes

Tocklai Experimental Station of TRA
Tea Research Institute of UPASI
Indian Institute of Plantation management – IIPM.

VISION FOR FUTURE GROWTH

1. Institutionalize and establish International Society of Tea Science with representatives in major tea growing and tea consuming countries.

2. On line data provider having well developed linkages with global tea research Institutes and

abstracting services for comprehensive coverage of all published tea research in various languages.

3. Organizing regular chat shows to answer queries of readers of IJTS, researchers and users of tea research.

4. Repository of data on:
   - Profiles of global tea research institutes
   - Status and track record of tea research in producing and consuming countries.

5. Publications – Journal, Books, Directories, Bulletins and Special reports
   - Journal: - Regular publication of International Journal of Tea Science to carry quality research papers, topical reviews; statistical analyses and scientific abstracts.
   - Books: - Propose and publish comprehensive treatises on selected topics e.g. Chemoprotective Effect of Tea on Human Health, Critical issues facing the tea industry, Pesticides residues and biopesticides.
   - Directories: Tea researchers, planters, consultants and input suppliers.
   - Special reports

6. Website development and linkages with other tea websites.

7. "Certified Plantation Professionals" program for up-gradation of the quality of field managers with examination and training programme, organized Jointly with IGNOU, Tea Board of India, TRA, UPASI, IIPM, Tea Industry and other stakeholders.

8. Promotion of Inter institutional research projects on emerging areas of significance. The current list includes:
   - Technology of value added products of tea.
   - Research information sharing network.
   - Germ plasm characterization.
   - Biological control of Invasive species of tea mosquito and other pests, diseases and weeds.

9. International conferences on global advances in tea science in collaboration with national and international agencies.

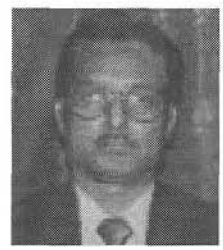
The International Society of Tea Science (ISTS) welcomes its members and well-wishers to participate in making the vision for future growth a reality through making suggestions and contributing papers on the subjects of their specialization for publication in the society journal and books as well as promoting other useful activities.

Chapter 48

TEA RESEARCH AND DEVELOPMENT – PRESENT STATUS AND FUTURE STRATEGIES FOR NORTHEAST INDIA

A. N. Mukhopadhyay*

(Former Director General, Tocklai Experimental Station, Jorhat – 785 008, Assam).



Prof. Mukhopadhyay is a distinguished Plant Pathologist, an inspiring and an able administrator. He had his college education and doctoral training at Banaras Hindu University (BHU). Starting his career as Instructor in Plant Pathology at BHU in 1962, he later joined the Department of Plant Pathology, G.B. Pant University of Agriculture and Technology (G.B.P.U.A.T.), Pant Nagar in 1967 as Assistant Professor, and rose to the position of Associate Professor in 1971. He worked at the University of New Castle Upon Tyne, U.K. on a Commonwealth Academic Staff Fellowship (1977-1978). He became Professor and Head, Department of Plant Pathology, Gujarat Agricultural University in 1982, and moved back to G.B.P.U.A.T. as Professor and Head, Plant Pathology in 1984 and served as Dean (1992-1997). In 1997, he was appointed Vice-Chancellor, Assam Agricultural University, and was later appointed Director General, Tea Research Association, Tocklai (2000).

Prof. Mukhopadhyay has been a teacher of rare distinction ad has motivated innumerable students to choose Plant Pathology as their career. He is renowned for his pioneering work on Bio-control of Plant diseases and has been instrumental in bringing this subject to the forefront of agricultural research in the country and in South-East Asia. He has published over 130 research papers and has authored/edited eight books on Plant Pathology publisherd by internationally renowned C& C Press (USA) and Prentice Hall (USA).

Various awards and honours have been conferred to him : Professor M.J. Narashimhan Academic Award, Professor M.S. Pagvi Award, Fellow of National Academy of Agricultural Sciences. He has been Editor-in-Chief, Indian Journal of Mycology and Plant Pathology (1984-1987), President of the Indian Society of Mycology and Plant Pathology (1986-1987), President of the Indian Phytopathological Society (1995) and the President of Agriculture Section of the Indian Science Congress (1996), Membership of the Working Group of Emerging Plant Diseases in 1993 by the Federation of American Scientists (USA) and WHO (Geneva).

INTRODUCTION

Next to water, tea is the most popular non-alcoholic beverage in the world. Indian tea industry produces about 840 million kg of tea from about 0.5 million hectares of land. Northeast India produces about 75% of total Indian production. The industry has annual turnover of Rs. 6000 crores and provides employment to 1.2 million people of which 50% are women. It also earns valuable foreign exchange of Rs. 2000 crores from export of quality tea. Indian tea industry contributes Rs. 1100 crores annually to Indian economy as taxes and duties. The above facts signify the importance of tea industry in the socio-economic scenario in India. Tea occupies an important place in our social and cultural life and is offered as a gesture of hospitality and goodwill at Indian home. Any time is "teatime". India has the unique distinction of being the largest producer as

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well as the consumer of tea. India's position in this regard is not only unique but also unparallel. Ecofriendly environment is the need of the hour throughout the world. The lush green tea estates provide the ecofriendly environment for the entire tea-growing region. Indian tea industry now faces a challenging task of producing more than 1000 million kg of quality tea.

TOCKLAI EXPERIMENTAL STATION

Chinese knew the discovery and use of tea as a stimulating beverage and medicine. The history of tea industry in India is the history of pioneering efforts of British East India Company, who explored possibilities of growing tea plants in India. Tea committee instituted by Lord William Bentinck brought tea seeds from China and grew in some places in India. Robert Bruce in 1835 discovered native tea plants in Assam. Cultivation of large Assam type tea was undertaken and chest of tea was sold in England on the 10th January 1839. That tea had a distinctive colour and taste, which was appreciated by world community. It became very clear that introduced Chinary tea plants was devastated by pests and disease while indigenous tea plants were completely free and gave high yield.

In the nineteenth century ITA appointed Dr. H. H. Mann to initiate research on tea at Calcutta. The British pioneers soon realized the importance of research and development in tea and its proper implementation for increasing productivity. Organized research in tea, however, started in 1911 when a research complex was set up on the loop of the rivulet Tocklai, a place 6 km from Jorhat. Since then it is the oldest and the largest tea research station of its kind in the world. Planting materials, tea machineries and processing technologies developed by Tocklai are used not only in India but spreaded in all tea growing countries of the world.

MANDATE OF TOCKLAI

Tocklai carries on and promotes research on all aspects of tea cultivation and processing with the principal objectives of improving overall productivity and quality. The information generated from its R & D activities is effectively communicated to the tea industry through a network of advisory services. Toklai has seven advisory centers in northeast India.

TOCKLAI CONFERENCE

During 1935 Prof. Sir Frank L. Engledow, who headed the 1st commission of enquiry, recommended holding of Tocklai Conference. The first Tocklai Conference was held two years later in 1937. The Tocklai Conference is an international event, which brings together planters, scientists, traders and administrators in one platform for exchange of experiences. The Tocklai Conference has been the principal guiding force in the noble pursuit of knowledge for scientists, planters and consumers as well.

SUCCESS STORIES OF TOCKLAI

Tocklai Experimental Station during its nine decades of existence has been actively engaged in serving tea industry of northeast India through its R&D and technology transfer services. The impact of agrotechnology is visible from the progressive increase in production and productivity.

The production of tea in northeast India has increased from 23.3 million kg in 1951 to recent production of 669 million kg in 1998 while the productivity increased in the same period from 820 to 1940 kg/ha. This spectacular increase in productivity was accomplished due to intensive research and development and their fruitful implementation. An estimate showed that the average productivity of TRA member estates is about 51% more than the non-members.

MAJOR ACHIEVEMENTS IN TEA AGROPRACTICES BY TOCKLAI

Before 1950: Introduction of annual prune, improved pest control measures, drainage, clonal propagation of tea from single node cuttings, importance of legume as shade and release of TV1, TV2 and TV3.

Between 1950–59: Vegetative clones TV4, TV5, TV6, TV7, TV8 and TV9 released and the standardization of tipping level at 5 leaves.

Between 1960–69: Balanced NPK manuring, introduction of longer pruning cycle, planting pattern density and recommendation of herbicide.

Between 1970–79: Introduction of micronutrient, potash application basis, biclonal seeds and their release, drainage improvement and young tea management.

Between 1980–89: Plant growth regulators for crop productivity, introduction of tissue culture in tea, introduction of polyploid clones and improved pest control methods through IPM.

Between 1990–2000: Biopesticide *Trichoderma*, package for *Helopeltis* control, drip irrigation and drainage improvement, tissue culture techniques, new biclonal seeds and clones and establishment of Pesticide Residue Laboratory.

PROBABLE REASONS FOR REDUCTION IN PRODUCTIVITY, PRICES AND EXPORTS

Indian agriculture has witnessed a slump in most agricultural sectors and tea is no exception. It is generally believed that high input agriculture has depleted the soil of its mineral nutrients. In other words what has been taken out of the soil has not been ploughed back thereby creating nutrient imbalances in the tea soil.

Reasons for decline in production and productivity can be outlined as follows:

1. **Old age of tea bushes:** Estimate shows that 43% of our tea is more than 50 years old and most of such area has passed the economic longevity with concomitant decline in yield. On the other hand the average rate of replantation is less than 0.4% against the required rate of replantation of 2.5%.
2. **Intra and inter estate disparity in yield:** Significant intra and inter estate variations in productivity suggest the need to examine critically the factors limiting the productivity. It is also essential to bridge the yield gap between high and low yielding estates, and regions as well.
3. **Lack of better planting materials:** Tocklai has so far developed 30 TV series clones and 14 tea seed jats along with 154 garden series clones for region specific requirements. There is need for better clones with high productivity and quality.
4. **Exports and tea marketing:**
   - Slumps in exports of Indian tea have taken place in the recent past. There is a demand for quality tea in the world tea markets at cheaper price.
   - There is also a growing demand for organic tea and the global demand for green tea is on the increase.
   - Indian tea Industry is to fulfill some obligation in view of the WTO agreement and increase the production of high quality tea for the consumers.
   - Since tea is considered as food commodity, one must ensure that product reaches the consumers and is safe for consumption. It is, therefore, imperative to implement the concept of HACCP (hazard analysis and critical control point).
   - Trade liberalization among SAARC countries may bring India into a field of stiff

competition with other tea producing countries like Sri Lanka, Bangladesh and non-SAARC countries like China.

- Tea consumption rate in younger generation has declined steadily, probably because of more inclination towards soft drinks.

MEASURES FOR INCREASING PRODUCTION AND PRODUCTIVITY – PRESENT STATUS AND FUTURE STRATEGIES

Keeping in view of industries' need and sustainable agriculture Tocklai has drawn up strategic research plan. These plans highlighted more than two dozens broad based research areas and priorities of investigations. Most of the major projects are multidisciplinary in nature and require considerable financial and technical cooperation. All India Coordinated Project on Tea Biotechnology and Tea Improvement is initiated under DBT, and Tocklai is one of the collaborating institutes in India. Some of the areas of investigation are: plant nutrition, soil management, water management, bush architecture, pruning, plucking, shade management, integrated pest management, soil rehabilitation, tea biochemistry and pharmacology, tea processing, modernization of tea factories, improved planting materials etc. At present there are several internally and externally funded projects in these areas.

Rejuvenation and Consolidation

Results of survey indicates that about 40% of the existing tea is above 50 years old. Because of vacancy, age, high frame and low plant population the productivity of this group of tea is low. Such teas are to be uprooted and replanted in a phased manner. Since uprooting and replanting are costly inputs and sufficient fund is required to accomplish the jobs, rejuvenation pruning and consolidation and infilling/interplanting is a stopgap measure applicable to areas, which have high probability to produce desired yields. Loss of crop due to rejuvenation pruning could be compensated in 4-5 years by infilling alone, while infilling with interplanting reduced the period of crop recovery to 2-3 years.

New Cultivars

The cultivation in northeast India was started with seeds brought from China and later from Indo China region. Tea was also found growing wild in the hills of northeast India. The Chinary tea seeds obtained were highly heterogeneous, highly susceptible to diseases and pests and productivity was low. Nevertheless they provided an excellent base for breeding and selection of cultivars for higher yield and better quality. The first set of TV series clones developed through selection was released in 1949. New cultivars were developed either from existing natural variability in the population or by creating variability artificially through hybridization, mutation and polypolidy. So far 30 TV series clones and 14 hybrid seed varieties were released to the industry. Besides more than 154 region specific clones were developed by selection in different estates. It has been estimated that about 5000 ha are brought under tea every year by extension and replanting with latest released clones and seed cultivars. Moreover, clones with higher productivity and quality are the needs of the hour. Two high quality TV clones, P463 and P492, one of them having mild aroma, are due for release after commercial evaluation. Six clones for Darjeeling are in the pipeline and given to different estates for commercial evaluation. Similarly two drought tolerant clones are undergoing tests.

Bush Architecture

Technique of young tea management underwent constant change with a view to obtain long sustained yield. However, survey of tea areas in northeast India revealed progressive decline in the economic age of the bush. Introduction of closer spacing, use of undesirable cultivars, compromise

in formative prune for quick return etc. are the likely factors for the decline. To arrest the deterioration of economic age, method of improvement of bush architecture will be aimed at through manipulation of techniques of young tea management based on observed characteristics of ideal bush frame of existing plants as well as by increasing harvest index through enhancement of total biomass production and its partition.

Water Management

Survey showed that about 50% of the tea area suffers from either water logging or drought or from both. Water logging has been serious cause of concern for the tea industry of northeast India. Out of 0.335 million ha of area under tea in the region it is estimated that 0.2 million ha of the plantation needs drainage improvement. Studies on water management have helped to determine the criteria for drainage design, development and layout of open as well as underground pipe drainage system based on soil climatic parameters. The period of moisture deficit is from November to April and the deficit varies from 8 mm to 300 mm in upper Assam and Terai respectively. Improvement of drainage causes about 20–25% increase of crop yield.

For sustainability of productivity water management plays a major role. Solution of this problem is no longer available within the estate boundary. In the days to come we have to search for the solutions on macro-catchments basis. To find out best solution base maps have to be prepared by satellite based geographical information system (GIS).

Protection of Darjeeling Tea

India has tremendous geographical advantage to produce tea of separate identity. For example Indian tea produced in different agro climatic zones has distinctive character and is renowned for certain inherent qualitative characters. For example flavour of Darjeeling tea and liquor of Assam tea have attained an identity of regional produce and always fetched premium price. Government must take appropriate measures to provide legal protection to those teas under geographical indications. India has the reputation of acquiring intellectual property rights for basmati, haldi and garlic.

Darjeeling tea has attained a status of distinct regional identity and is a subject of intellectual property rights of our nation. The union cabinet has cleared the proposal to enact laws for the registration and protection of geographical indication of goods, including Malabar pepper, basmati rice, Alhphanso mango in India, and Darjeeling tea comes under the ambit of this legislation (Registration and Protection Act 1999). The proposed legislation would provide better protection of industrial property of distinct characteristics.

Biotechnology

Neither Indian industry nor India organization can ignore the new competitive global environment in which they are called upon to operate. Our tea industry has to improve its manufacturing and management practices; we should be freed from infrastructure, investment and other constraints that have prevented it from growing to its full potential. We have to minimize the cost and maximize the quality and we have to be better at marketing internationally. In the age of biotechnology and information technology, sky is the limit. Biotechnology will shape the future of tea. There is no reason why in tea like other crops the biotechnologist cannot make a "tailor made tea plant" of tomorrow – it should be quick growing short bush, which should cover the ground within a year of planting and produce fast growing chunky shoots bearing quality leaves. The bush must be sensitive to inputs but should not be sensitive to day length and temperature, and it should continue to produce green leaves throughout the year.

Gene transfer in suitable background would provide tailor made tea plant.

Plant Protection

Pest control scenario in tea has undergone considerable change with the passage of time. Loss of crop due to pests in tea varies from 15 – 25%. Integrated pest management (IPM) has been placed in the thrust areas of tea research. Climatic conditions and bio-ecology of pest species and natural enemies have been critically evaluated to evolve effective control strategy. Non-chemical methods have been given due importance, while extreme care has been exercised to select and recommend a pesticide for use in tea keeping conformity with international pesticide regulating agencies like EPA, Codex etc. and CIB in India. International working groups on IPM in developing countries have identified IPM approach as the viable alternative for agricultural pest management, which has profound socio-economic and environmental significance. Utilizing native parasites, predators and pathogens identifies biological control of pest by utilizing native parasites, predators and pathogens to be one of the most attractive tools for management of pests.

Termites and *Helopeltis* have assumed a status of major pests in tea and are identified to be one of the major constraints of improving productivity. Termite pests are being extensively studied and successfully controlled by using fungal pathogens. We have isolated several native fungal pathogens of termite and *Helopeltis* pest from the tea ecosystem and the prospects of utilizing them as microbial pest control agents are being explored.

Information Technology

TRA has already initiated works to develop a database for each member estate to improve the promptness, effectivity and quality of advisory services.

Electronic Monitoring and Control System

Tocklai has also recently developed an electronic monitoring and control system for withering under a collaborative work with CEERI, Pillani. The equipment is undergoing extensive trials under different agro climatic zones. It is expected to revolutionize the process of manufacturing in near future. Moreover, design modification of existing withering troughs, developed by TRA has also made a significant impact on the industry.

Product Diversification

Product diversification of tea has become more important in recent years. Products like ice-tea, organic-tea, flavoured-tea, and instant-tea are gaining grounds particularly in overseas market/non tea-drinking countries.

Tea as Health Drink and Generic Campaign

Annual consumption of tea in India is about 650 million kg and daily per capita consumption being less than a cup. During last decade the younger generation of the age group 18-25 years comprising 60% of population in our country developed remarkable liking for carbonated drinks. The tea had one of its worst years in 2000-2001. Recent research findings on health benefits of tea would prove extremely useful in creating public awareness for increasing consumption of tea especially among younger generations. India Tea Association in conjunction with Consultative Committee of Plantation Association (CCPA) has decided to go for generic advertisement on tea keeping in view the successful generic advertisement campaigns to promote egg and milk consumption. The generic advertising, opposed to brand advertising, will inform the consumer of the virtues of tea drinking, while depending heavily on the unhealthiness of consuming carbonate soft drinks. This would directly take on the soft drink manufacturers, who in last few years managed to make a big dent among traditional tea drinkers. Let us promote tea as the "Super Beverage" of the new millennium.

Research in processing technology, biochemistry of tea, packaging and exploring medicinal values of tea are of immense importance and have been taken up for generating new information.

Tea Research Association, UPASI and Institute of Himalayan Bioresearch Technology in India are working to provide location specific R & D needs in appropriate areas of tea science. A close interaction at national and international level is essential in solving some intricate problems of basic as well as applied research in tea.

CONCLUSIONS

The role of R&D undoubtedly will be crucial in increasing productivity. Agrotechnolgy generated through R&D activities is identified to be a vital input for improving soil health, acquiring ecological stability and enhancing bush productivity.

An estimate has revealed that world top 300 international companies invest 4.6% of sales turnover in R&D. However, the average expenditure for Denmark is as high as 16.8% and above 4.8% for American companies. There is no precise information about the R&D expenditure in India. However, it has been found that at present the public sector investment in agricultural research in India is only 0.46% of the agricultural GDP as compared to 2% in developed countries. The situation is even deplorably low in case of tea research in India. The tasks ahead of tea industry are no doubt challenging and more and more competitive and unpredictable. In such an environment the R&D must be strengthened.

India has witnessed green, yellow, blue and white revolution in the area of cereals, oilseed, fish and milk respectively. I consider Tocklai Experimental Station, TRA as the jewel in the crown of tea research institutes of the world. The time is not far off when with the concerted effort of dedicated band of scientists at Tocklai, government and industry we will achieve "**Golden Revolution**" by increasing the production and productivity of quality tea in northeast India. **Nothing great was ever achieved in this world without hope and enthusiasm. Hope is the pillar that holds up the world. Let our hope aim at the stars.....For even if we fall short we will land on the moon.**

Chapter 48

WTO AND AGRICULTURE TRADING IN FOOD INSECURITY

Devinder Sharma*

For any tourist, Kerala, in down south India, is an attractive destination. The tropical climate and the unique backwater systems have added charm to its pristine beauty. Add to it the stupendous growth in literacy and the overall growth in human development, Kerala has rightly earned the sobriquet: "God's own country".

But over the past few years, ever since economic liberalization became the development *mantra*, Kerala has been on the receiving end. Flooded with cheap and highly subsidized agricultural imports, its agrarian economy has been thrown out of gear. Whether it is the import of palm oil or rubber or coffee, almost every aspect of the State's socio-economy has been negatively impacted.

Coconut prices have crashed, down from Rs 10 to Rs 2. Rubber has plummeted from Rs 60 to Rs 16 and coffee from Rs 58 in 1999 to Rs 30 per kg in 2000. Even spices have not been spared, with pepper prices falling from Rs 2,600 to Rs 1,300 per quintal in the consecutive period. While Kerala farmers are naturally a worried lot, the changing global intellectual property rights (IPRs) regime is certain to further throttle domestic agricultural research, which in turn will adversely impact agricultural production including that of spices. And the repercussions will eventually be felt by the industry, which will find the export market restricted and monopolized by the patent-holders.

Kerala's tea plantations are amongst the worst affected. Over a million people depend on tea plantations for their living. Out of 32 tea factories functioning in one of the popular tea growing regions — Peermade taluk — 18 have pulled down the shutters. Their owners, leaving some 30,000 people jobless in High Ranges alone, have abandoned another 13 tea estates. Until the WTO regime began, plantation products from Kerala – tea, coffee, cardamom and pepper - found excellent spice markets and earned considerable foreign exchange. India produces 850 million tons of tea annually. The internal consumption is 670 million tons. "By exporting 180 million tons of tea India was accumulating a big sum in its foreign reserve. But the globalization-oriented new import policy has undermined the situation," says P S Rajan, President, Hill Ranges Estate Employees Association (1).[1]

Kerala is not alone. The destructive fallout from the emerging global trade paradigm is being felt all over the country, though not in the same magnitude. But before we talk of the bitter political harvests and the growing disenchantment with the World Trade Organization (WTO), it is important to understand why and how the market rules play against the Indian farmers, and for that matter farmers in the developing countries. Let us take the case of India.

It is now official. Eight years after the WTO came into existence, on 1st January 1995, the anticipated gains for India from the trade liberalization process in agriculture are practically zero. The Ministry of Agriculture as well as the Ministry of Commerce have officially admitted that the hopes from an international regime that talked of establishing a

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fair and market oriented agricultural trading system have been belied.

Let us first try to understand what went wrong and where. WTO's Agreement on Agriculture (AoA) had incorporated three broad areas of commitments from member states, namely in market access, domestic support and export subsidies. The underlying objective being to correct and prevent restrictions and distortions in world agricultural markets. On the other hand, the trading regime has ensured that developing countries take time-bound initiatives to open up their domestic markets for cheap and highly subsidized imports of agricultural commodities in the name of encouraging competition. Eight years later, it is now established that these measures have only protected the farmers and the farming systems of the developed countries.

MARKET ACCESS

Increased market access was the hallmark of the free trade agenda. It was aimed at force opening new markets for agriculture exporters. The AoA required all countries to allow a certain minimum market access for every agricultural product at five per cent for developed countries and four per cent for developing countries. Southern nations, with low cost of production, were always told that the developed countries would have to open up their markets for cheaper food imports as a result of which the developing countries would gain enormously.

A recent study by the Food and Agricultural Organization of the United Nations (FAO), however, concludes that there has been hardly any change in the volume of exports. Tariff peaks or in other words high import duties continue to block exports from the developing countries. Tariffs still remain very high, especially in case of cereals, sugar and dairy products. These countries have managed to fulfill the technical requirements for tariff cuts under AoA without any meaningful reductions. Technically speaking the reductions in tariff cuts are in place, but in reality they have defied the letter and spirit of the agreement. Although the US, EU, Japan and Canada maintain tariff peaks of 350 to 900 per cent on food products such as sugar, rice, dairy products, meat, fruits, vegetables and fish (2), the thrust of the ongoing negotiations remain on pierce opening the developing country markets to more subsidized exports.

As if massive subsidies were not enough, developed countries have used high tariffs to successfully block imports from developing countries. They have used special safeguards (SSG), used only by 38 rich countries so far, to restrict imports from developing countries. Developed countries took advantage of this flexibility by reserving the right to use the SSG for a large number of products. Canada reserves the right to use SSG for 150 tariff lines, the EU for 539 tariff lines, Japan for 121 tariff lines, the US for 189 tariff lines, and Switzerland for 961 tariff lines. On the other hand, only 22 developing countries can use SSG. A majority of the developing countries, whose trade in agricultural products takes place under a tariff only regime, have no access to these instruments (3).

India was forced to either phase out or eliminate the quantitative restrictions (QRs) on agricultural commodities and products latest by April 1, 2001. India has, therefore, opened its market and in turn made the farming community vulnerable to the imports of highly subsidized products. Already, the spurt in the import of pistachios, spices, apples, rubber, tea, coffee, cotton and soybean oil is causing concern. A number of other products like wheat flour, poultry and alcoholic beverages are also being watched very closely by the government.

Import of pistachios has grown from Rs 310 million to Rs 670 Million during April-September 2001 as compared to the first six months of the previous financial year. The import of apples has increased 100 per cent during the same period, from Rs 120 million to Rs 240 million. The increase in the imports of tea and coffee has already prompted the government to raise the custom duties in the Budget 2002-03.

Elsewhere, the picture is equally bleak. In Central America — Colombia, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua – the price of coffee beans have fallen to just 25 per cent of its level in 1960, and the region lost an estimated US $ 713 million in coffee revenues in 2001. In these countries, traditionally dependent upon coffee exports, over 170,000 jobs were lost the same year with the loss in wages computed at US $ 140 million (4). The negative impact was also felt in sub-Saharan Africa, where Ethiopia and Uganda reported huge losses in export revenues. In 2000-01, Uganda exported roughly the same volume, but it earned the country $ 110 million, a steep drop from $ 433 million that it notched five years earlier in 1994-95 (5). Ethiopia reported the export revenues dropping from US $ 257 million to US $ 149 million between 1999-2000. Ironically, in January 2002, the EU and USAID warned of increased poverty and food insecurity in Ethiopia not realizing that much of the fault rests with their own policies.

DOMESTIC SUPPORT

Clever manipulation of their subsidy reduction commitments has in reality increased the support to farmers in the developed countries. In the United States, subsidy to mere 9,00,000 farmers has increased by 700 times since 1996. Two years before President Bill Clinton left the office, the US had provided an additional US $ 26 billion dollars to its farmers. His successor, George Bush, has in April 2002 provided another $ 180 billion to farmers for the next 10 years, of which 100 billion will be given in the first three years. In absolute terms, the farm support in the OECD countries increased by 8 per cent to reach the staggering figure of US $ 363 billion in 1998.

In the European Union (EU), direct payments to farmers after the reforms initiated in March 1999 to the Common Agricultural Policy, now account for 126 per cent of the net income of cereal producers and 129 per cent for the bovine meat producers. And this falls under the 'blue box'. New EU Common Agricultural Policy reform proposals that have been announced prior to the Cancun WTO Ministerial have also made no attempt to make radical changes in reduction commitments. Moving on US lines, it has shifted most of the 'blue box' subsidies to 'green box'. European agriculture will continue to be subsidized to the tune of Euro 43 billion for another decade, and that amount will increase further when the new members join in. Like a magician, both the US and EU have managed to juggle the farm support from one box to another without making any significant commitments.

The colourful band of boxes – green box, blue box and amber box – have come in handy for the rich countries to protect their subsidies to agriculture, and at the same time dump the surpluses all over the world. Considering that the world commodity prices are far from adequate anywhere to provide them with a living, these subsidies are actually the cause of excessive supplies in the world markets, and thus resulting in low prevailing world markets. Still further, US is permitted under AoA to provide $ 363 million in export subsidies for wheat and wheat flour, and the EU can limit it to $ 1.4 billion a year (6). At the same time, the US incurs annually $ 478 million under its Export Enhancement Programme (EEP), which is not being subject to any reduction commitments.

It was anticipated that due to reduction in domestic support in developed countries, cereal production would shift from developed countries to developing

countries. Empirical evidence, however, shows that such a trend is not at all visible. In fact, all indications (and efforts of World Bank/IMF) point towards making the developed countries the hub of cereal production. The Bretton Woods institutions have been asking developing countries to diversify to cash crops as a pre-condition for advancing loans. In other words, while the developing countries shift from cereals to cash crops like flowers and vegetables, they are left with no option but to import staple foods. Moreover, with such massive subsidies intact, and with the QRs lifted, developing countries are sure to be inundated with food imports – a process that has already initiated further marginalisation of farming and farm communities.

EXPORT SUBSIDIES

WTO enables only 25 countries to provide export subsidies for their agricultural products and commodities. Other countries, which do not have agricultural export subsidies, like India, cannot make any new provisions for it. Export subsidies that need to be pruned, as per a formula, are not provided in India. On the other hand, the US continues to find legitimacy for even export credits, which are actually used to promote and push American agricultural exports.

With the availability of all such subsidies, agribusiness companies find it much easier and economical to export. Export credits, used primarily by the US, and not counted as export subsidies, doubled in just one year to reach US $ 5.9 billion in 1998. The export subsidies and credits are, therefore, cornered by the food exporting companies. In the US, for instance, more than 80 per cent of the corn exports is handled by three firms: Cargill, ADM and Zen Noh. The level of dumping by the US alone hovers around 40 per cent for wheat, 30 per cent for soybeans, 25 to 30 per cent for corn and 57 per cent for cotton (7). Further, each ton of wheat and sugar that the United Kingdom sells on international market is priced 40 to 60 per cent lower than the cost of production (8).

The shocking levels of food dumping and its little understood but horrendous impact on the farming sector in the developing countries is the result of clever manipulations at the WTO. The US and EU were successful in ensuring that some subsidies –and that included direct payments — have little or no impact on production levels and so have little or no impact on trade. Using sophisticated models and taking advantage of the un-preparedness of the developing country negotiators, they devised a complicated set of rules that termed only 'amber box' subsidies as 'trade distorting' that needs to be cut. As it turned out, these were the type of subsidies that the poor countries were also using.

The Indian Ministry of Agriculture acknowledges that despite the rules being defined, the expected gains have eluded the developing countries. It was expected that with the removal of trade distorting measures, agricultural exports from the developing countries would increase. This did not happen. In fact, India has on the other hand seen a massive increase in the imports of agricultural commodities and products – from about Rs 50,000 million in 1995 to over Rs 1,50,000 million in 1999-2000 – a three-fold increase. In edible oils alone, the import bill has soared to Rs 90,000 million. The so-called fair trading system has also not helped efficient producers in realizing a higher price for their products. On the contrary, prices of most agricultural commodities are declining in the world markets.

PUBLIC STOCKHOLDING OF GRAINS

Unlike the European countries where the public distribution system (PDS) was discontinued after the Second World War, its importance has grown for an overpopulated and poverty-stricken country like India. It was with the basic objective of curbing consumption and ensuring an equitable distribution

of available food supplies, especially in the deficit areas and among the poorer strata of society, that the PDS was introduced more than 50 years ago. How effective the PDS has been as a welfare measure can be gauged from the Seventh Plan document of the Indian Planning Commission: "The PDS will...have to be developed that it remains hereafter a stable and permanent feature of our strategy to control prices, reduce fluctuations and achieve an equitable distribution of essential consumer goods."

AoA allows developing countries to use public stockholding of food grains for food security purposes "provided that the difference between the acquisition price and the external reference price (i.e. the international price) is accounted for in the AMS". At the same time, member countries have been asked to identify the beneficiaries on the basis of "clearly-defined criteria related to nutritional objectives".

In other words, AoA has circumscribed the capacity of the government to intervene in the market to ensure needs of the food security. After all, if India were to acquire food grains for stockholding under PDS at the international prices, the budget allocations will mount beyond manageable limits. Any tinkering with the public stockholding of grains is sure to lead to food insecurity, as has been demonstrated in many countries, which have done away with public stockholding of grains. And yet, the government is making desperate attempts to decentralize the public stockholding of food grains in an obvious attempt to dismantle the main plank of what is called the 'famine-avoidance strategy'.

Internationally, powerful multinational companies are trading food. By passing on the reins of the nation's food security to these companies and the trading blocks through a policing system under the WTO, India is witnessing a gradual collapse of food self-sufficiency and the scrapping of the public distribution system, the very foundations of food security. It is quite clearly visible that the new trade regime in agriculture only aims at eliminating the hungry and not hunger, the small and marginal farmers and not unsustainable agriculture. Added to this are the agreement on trade-related intellectual property rights (TRIPs) and the sanitary and phytosanitary measures, the dominance of Indian agriculture becomes complete.

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INDIAN TEA: STORM IN THE TEA CUP

When the Indian markets were opened to foreign goods, tea dusts from 13 countries started to flood in. Sri Lankan tea is imported by paying merely 7.4% of import duty. Though the import from Sri Lanka - 15 million tons - is only a small percentage of the total Indian production, it is creating havoc in the South Indian market, especially in Kerala.

"Producers from South India were demanding a sharp increase in the import duty for Sri Lankan tea. But the government increased the duty from 7 per cent to only 15 per cent", says Lalaji Babu, General Secretary, All India Plantation Workers Federation, CITU. South Indian planters have asked the government to raise import duties on plantation crops. They argue that the customs duty on tea and coffee could be increased to bound rates even as per WTO norms. Nonetheless, the government has been going ahead with the move to bring down import tariffs on agricultural products under the WTO pact.

Surplus production and reductions in tariff barriers are said to be the main reasons for the present crisis in the tea gardens in the state. Prices of most plantation products - tea, coffee and rubber - in both domestic and international markets have been witnessing a steady decline over the years. Tea is the worst hit with the price well below the cost of production. The average auction price of the tea at present is Rs. 47 per kg against the cost of production of Rs. 60 per kg. "This is a market-driven humanitarian crisis. It is the result of the wrong policy initiatives of the Central Government under globalization agenda," points out C. S Rajan.

Kerala's labour minister Babu Divakaran also blames the WTO. "Tea industry the world over has plunged into a crisis owing to globalization policies. A small state like Kerala is incapable of solving the issue singularly. We are pleading our case with the Center," says Divakaran.

Source: <http://indiatogether.org/2003/may/eco-keralatea.htm>

DESTROYING INDIA'S OILSEEDS REVOLUTION

India recorded a spectacular increase both in area under oilseeds as well as its output, with production doubling from 11 million tons in 1986-87 to around 22 million tons in 1994-95 thereby justifying the term "yellow revolution". The near self-sufficiency of edible oils was, however, not palatable to the economic pundits as well as the so-called market forces.

But this was not palatable to the World Bank. While acknowledging that oilseeds had demonstrated a rate of growth that exceeds the national trend, it actually called for discarding the policies that had brought about the positive change. World Bank's argument was that India lacked a "comparative advantage" in oilseeds when compared with the production trend in the United States and the European Union, and should, therefore, be importing edible oil. It was, however, known that the support prices paid to Indian groundnut and mustard growers were less than the support prices paid to the groundnut and mustard farmers in the US and Europe.

What the World Bank, however, did not say was the selling price of India's oilseeds per ton was equivalent to the production cost of one ton of oilseeds in the US. Moreover, the production cost in the US would have been still higher if the massive amounts of subsidies that it doles out to its farmers were to be withdrawn. In fact, it is the US which actually suffers from a "comparative disadvantage" given that the fact that its subsidies distort the price. The US and more importantly the EU should, therefore, be importing edible oil from India every year given its cheap cost of production.

Ignoring the ground realities, and blindly following the World Bank's flawed prescription, (under pressure since India was restructuring its economy as per the SAP) India started the process of phased liberalization of edible oil imports from 1994-95. And this was at a time when edible oil exporting countries like Malaysia, Indonesia and Brazil were preparing to flood the Indian market with palm and soya oil. Two years later, the negative consequences of liberalizing the edible oil policy became clearly visible. With the country's edible oil import bill soaring to nearly US $ 1 billion during

1996-97, it was the Ministry of Agriculture, which pressed the panic button.

While the wholesale prices of edible oils rose by an estimated 14 per cent, production slackened. The only beneficiary of the government's "disastrous" policy was the private trade, which imported sunflower oil and palmolein at about Rs 22,000 per ton and after blending with groundnut and mustard oils, sold it for Rs 38,000 per ton. The free import regime neither benefited the farmer nor the consumer.

But then, the government is committed to protect the economic interests of the oilseeds trade and industry. Or else how can one explain that the decision to allow one million tons of soybean in 1998 at a time when the US was burdened with an unmanageable glut in production. Such was the government's desperation to import soybean, and that too at a time of no apparent crisis, that it was willing to overlook the fact that the imported seed was coming with five exotic weeds and at least 11 viral diseases. Moreover, this would have been the first major consignment of genetically engineered grain to be imported without any regard for health and environmental risks associated with the manipulated gene.

In a complete reversal of the objectives enshrined in the ongoing Technology Mission for Oilseeds, imports of vegetable oil between November 1998 and July 1999 have risen three-fold. Compared to the import of 1.02 million tons imported in 1997-98, the imports multiplied to 2.98 million tons. In 1999-2000, India imported five million tons of edible oil thereby once again emerging as one of the biggest importer of edible oil.

Since oilseeds is a crop of the dry lands, the adverse impact is being felt by millions of farmers languishing in the harsh environs of the country. With their most economic livelihood lost to edible oil imports, it shouldn't come as a shock if more and more oilseed growers begin to commit suicides.

Chapter 50

GREEN TEA INDUSTRY IN INDIA

Bharat Sarronwala*

Mr. Bharat Sarronwala, an engineer by education, is one of the few who have been associated with the tea industry in North and South India for over 50 years — as a Planter, Visiting Agent, Tea Broker and finally CEO. Mr. Sarronwala is equally proficient with all aspects of tea manufacture and field operations, and trains his juniors like a high quality teacher. A brilliant analyst and a strategist, he has contributed enormously to the growth of Tocklai during the seventies when he was Vice Chairman of the Tea Research Association at what was then spelled as Calcutta.

Bharat now lives in Bangalore where he is Director and Adviser to a Tea Group.

INTRODUCTION

Tea (both black and green) is a drink of pleasure and health. It refreshes the mood, stimulates the body, tempers the spirit and calms the mind without causing drowsiness. In recent years, lot of research has been done on the health benefits of green tea. India produces annually 8-10 million kg of green tea. Tables 1-3 give an idea of the Indian share of production and exports in the world trade.

Table 1. World production of green tea (kg)

Country	1987	1997	+/- over 1987
India	10.34	8.27	(-) 2.01
Bangaladesh	0.92	0.14	(-) 0.78
Sri Lanka	1.28	0.57	(-) 0.11
Indonesia	31.06	28.00	(-) 3.06
China	301.10	443.16	+ 142.06
Japan	96.30	91.20	(-) 5.10
Vietnam	21.50	33.30	+ 11.80
USSR/CIS	24.00	2.00	(-) 22.00
Total	486.50	606.64	120.14
World tea production	2341.41	2638.85	297.44
Percentage of green tea out of total production	21%	23%	

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Table 2. Production of green tea in north and south India (kg).

Year	North India	South India	Total
1990 - 91	545668	181740	727608
1991 - 92	562955	180526	743481
1992 - 93	571142	164860	736002
1993 - 94	580948	187059	768047
1994 - 95	567907	178320	746227
1995 - 96	577552	183991	761543
1996 - 97	588605	186707	775312
1997 - 98	625520	212500	838020

INDIAN PRODUCTION & SALES

India produces annually around 8-10 million kg of green tea. This is done mainly by small tea companies or cooperative factories. Production areas in India are mainly in Himachal Pradesh in northwest, Tripura and Dooars in northeast, and Nilgiris and Kerala in south India. Most of the produce is consumed internally and a small quantity is exported to overseas market. About a decade ago Indian green tea had a good market in Afghanistan, Russia and Morocco and over 50% of Indian green tea production was exported to those countries. But the export to Afghanistan and Russia had a setback following political upheavals there. Some other potential markets are Germany, France, U.S.A., Tunisia, Morocco, Algeria and some middle-east countries. Japan also

consumes green tea but the variety they take is not produced in India. Due to its medicinal value, the health-conscious people of the west are gradually taking more and more interest in green tea. Total exports of Indian tea (black & green) are hovering around 190-210 million kg. And this can be boosted up if overseas markets are explored for Indian green tea (Table 3).

Table 3. India's share in world exports of green tea (million kg).

Country	1987	1997	+/- over 1987
India	4.71	3.00	(-) 1.71
Sri Lanka	1.01	0.47	(-)0.54
Indonesia	0.17	4.39	+4.22
China	69.54	78.77	+9.23
Japan	1.05	0.50	(-) 0.55
Vietnam	4.50	6.80	+1.70
Taiwan	1.40	0.69	(-) 0.71
Total	82.38	94.62	+ 12.24
World Tea Exports	973.18	1155.92	* 182.74
Percentage of Green Tea out of the total Exports	8.5%	8.2%	

EXPORT PROSPECTS OF INDIAN GREEN TEA

As in the case of black tea, the consumer preference for green tea also varies from country to country. There is a general agreement, however, that in dry leaf the green tea should have a bright olive green colour with no trace of brown or red. The Japanese green tea, preferred in Japan and USA, gives lemon yellow or greenish yellow liquor without any tinge of brown. The liquor of Chinese green tea, however, has a tinge of brown colour which is liked by consumers in China, North African countries and Japan.

The Japanese consumer prefers green tea having a characteristic sweetness and 'brothy' taste contributed by the sugars and amino acids present in the tea. Green teas, which are rich in caffeine and tannins, are disliked because they are considered to be somewhat bitter and astringent. A set of analytical data for green teas of different grade and origin is reproduced below (Table 4).

Table 4. Comparative analysis of green tea.

Kind of green tea	Total Catechin %	Total amino acid %	Caffeine %	Reducing sugar %
Indian green tea	12.56	1.23	2.52	0.65
Japanese Sen-cha High	8.111	3.00	1.57	0.83
Middle	9.56	1.17	1.91	0.86
Low	5.93	0.66	1.79	1.19
Gyokuro	7.21	2.94	2.71	0.64
Bancha	5.00	0.71	1.20	0.71

High caffeine and catechins in Indian green tea coupled with low amino acids make it rather unsuitable for Japan. The Assam variety of seeds and clones generally planted in India contain higher phenolics and lower nitrogen / caffeine ratio; the product is, therefore, brownish in colour, which is not liked in Japan. Afghanistan, Morocco, USA and the Middle East are the main markets for Indian green tea.

MANUFACTURING PROCESS FOR GREEN TEA IN INDIA

Orthodox Green Tea

Except for a few factories that may have Japanese type moon rollers and Olive tea drier drums, the majority use conventional rolling tables and chain-circuit dryers.

Deactivation

The deactivation or the killing of the enzymes in the leaf is done by subjecting the fresh green leaf to steaming at a pressure of 80 psi in a roaster for 4-6 minutes depending upon the standard of plucked leaf. Alternatively, many factories use Panning in a cylindrical M5 drum rotating over a furnace, which heats the leaf to 140-150 F to deactivate the enzymes.

Cooling

The deactivated leaves are taken out from the roaster and are immediatelyimmersed in cold water,

preferably ice cold, to bring down the temperature to around 4-10 C in about 10 minutes. The cooling can also be effected by spraying cold water over the leaf on the floor on a conveyor belt.

Water Removal

The surface water of the leaves is removed by blowing air over or through it for 15-20 minutes.

Rolling / Drying

The first rolling is usually done in an orthodox roller, preferably without battens, or a moon roller. After the first roll the leaf is ready for first fire, which is carried out in a conventional drier using an inlet temperature of 80 C and an exhaust temperature of about 48 C. The semi-dried leaf is then spread on the floor to a depth of about 2.5 cm and is allowed to cool or 'recover' for about 15 minutes. The product after the first fire is gummy and flaccid. It should normally be olive green in colour. The second roll is for about 30 minutes without pressure and this gives the leaf an attractive twist. After the second roll the leaf goes for the final drying in a conventional or Japan type rotary drum drier (rotary drier in few factories only). An inlet temperature of 100 C and exhaust temperature of about 50 C are used. Drying time is usually 18 minutes after which the leaf is spread to cool and is not sorted for 24 hours.

End Product

Appearance : Bright Greenish
Infusion : Light Greenish
Grade % : Bulk A 20%, Bulk B 25%, Bulk C 45%, Yellow leaf 4%, Stalk 6%45%, Yellow leaf 4%, Stalk 6%

CTC GREEN TEA

Tocklai Experimental Station in Assam has recently developed this new method for better cuppage. The process is based on both steaming and panning systems of deactivation.

Partial Drying

The leaves are partially dried in a conventional dryer at 100-105 C(212-221 F) inlet air temperature for about 10-15 minutes so as to bring the moisture content of the leaves down to 45-50%.

Maceration in CTC Machine

The partially dried leaves are then put through a 2-cut CTC process - the 1st cut being through an 8 tpi and the 2nd cut in a 10 tpi CTC machine. For coarser type of leaves a third cut may be necessary.

Drying

The cut leaves from CTC machine are dried in the conventional dryer with inlet hot air temperature of 100-105 C (212-221 F) for 25-30 minutes so as to bring down the moisture content of final product to 2.2-2.5%.

END PRODUCT

The teas manufactured as above are attractive bright greenish in appearance, with greenish infusion and excellent liquor character. The cuppage is much higher than that of orthodox green tea. The market for CTC green tea is yet to be developed. No commercial factory in India has installed this system so far as fannings and dusts of green tea fetch very low prices in India and abroad.

DOMESTIC CONSUMPTION

Indian consumption of green tea is mainly limited to Jammu & Kashmir and Himachal in the northern parts the country. These are hilly, cold areas and green tea is always consumed hot with some local spices and nuts. Amritsar in Punjab is the main wholesale market for green tea. This town has a large number of sorting factories to grade the green bulk tea according to the buyer's requirements. A large proportion of secondary and off-grades of green tea are purchased by chemical

units for extraction of ploypheno1s for use in the food industry. These off grades are sold directly by the producing factories as also by the sorting units.

With greater awareness of health, green tea is now available in packets as herbal tea in some major towns of India but the off take is still low.

NEW FRONTIERS FOR GREEN TEA

Besides being a "health" drink, green tea is being increasingly used for extraction of catechins for use in the pharmaceutical and nutraceutical industries. Many companies in India and abroad are working on this analysis and extraction. Properly manufactured green tea with maximum content of catechins could fetch much better prices. Indeed, instant green tea has a better price and demand today as compared to instant black tea.

The future for Green Tea could therefore be EXCITING.